System and Method for Design and Construction of Natural Stone Facade and Flooring

DESCRIPTION

Copyright Statement

Background of Invention

[Para 2] The use of natural stone as building materials for interiors and exteriors is growing rapidly, driven in part by the beauty of natural materials and technical advances in stone production. Slabs, tiles, and pebbles are some of the natural stone products used as building materials. Automated machineries used in quarrying and fabrication produce thinner stone slab and tile slices consistently. Advances in cladding and anchorage systems make installation easier and quicker. Pebbles, either naturally-weathered or machine tumbled, are collected and sorted according to type and size. They are either offered as loose pebbles or attached to a backing sheet for ease of installation.

[Para 3] The quality and look of a constructed natural stone project relies solely on the craftsmanship and artistic partiality of the installers or stone masons. Constructed natural stone projects rarely resemble the sample swatches and photographs at the planning stage. Thermal and humidity related issues, mismatched types, colors, and patterns are common problems

in constructed natural stone projects. Alternation to a constructed project is difficulty and costly. Remedial actions to an unsatisfactory project may involve total removal, followed by new installation. Several reiterations to achieve the desired design are not uncommon in the industry. This is costly in terms of wasted resources and financial penalties for late completion.

Detailed Description

[Para 4] In the following description, numerous details are set forth. It will be apparent, however, to one skilled in the art that embodiments of the invention may be practiced without these specific details. In other instances, well-known structures, devices, and techniques have not been shown in detail, in order to avoid obscuring the understanding of the description. The description is thus to be regarded as illustrative instead of limiting.

[Para 5] Reference in the specification to "one embodiment" or "an embodiment" or "another embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least an embodiment of the invention. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment.

[Para 6] In addition, select embodiments of the present invention include various operations, which are described herein. The operations of the embodiments of the present invention may be performed by hardware components or may be embodied in machine-executable instructions, which may be in turn utilized to cause a general-purpose or special-purpose processor, or logic circuits programmed with the instructions to perform the operations. Alternatively, the operations may be performed by a combination of hardware and software, and mechanical subsystem.

[Para 7] Moreover, embodiments of the present invention may be provided as computer program products, which may include machine-readable medium having stored thereon instructions used to program a computer (or other

electronic devices) to perform a process according to embodiments of the present invention.

[Para 8] Additionally, embodiments of the present invention may be provided as modular units of natural stones products that have been characterized and prefabricated to effect desired designs such as artistic expressions, letterings or logos, geometric or random patterns, or surface textures at any construction site.

[Para 9] Fig. 1 illustrates an exemplary system 100 for the characterization of natural stone materials in which the present invention may be embodied in certain embodiments. The system 100 comprises of an image data acquisition subsystem 110, consisting of a rotating turntable stage scale 112, multiple optical imaging and ranging detector arrays 114 interfaced to a data acquisition and control module 116.

[Para 10] Each individual natural stone product, such as slap, tile, or pebble, is transported sequentially to 112 where the weight of the product is measured. Multiple optical imaging and ranging detector arrays in 114 enables information containing spatial contour, surface, veining pattern and appearance, and three dimensional data to be collected. This information is then digitized and coordinated by 116 and processed further by computer system 120.

[Para 11] Information acquired by 110 is processed by a computer 120 consisting of hardware 122, operating system 124, imaging processing algorithms 126 and software to optimize design 128. Each individual natural stone product is then indexed and labeled if necessary in subsystem 130 and the optimized design is displayed and a report presented in subsystem 140.

[Para 12] Each natural stone product is then classified by software 126 operating under operating system 124 on hardware 122. An identifier tag code consisting of a representation of visual, geometric and other physical characteristics is then assigned to each natural stone product. The stone product is index and labeled if necessary in 130. A spatial optimization algorithm based on pre-selected design rules 128 is then employed to optimize the individual placement of each stone product.

[Para 13] When appearance is of paramount importance as specified by the architect or designer, such as stone sizes uniformity or veining pattern, the alignment of individual veining and size uniformity takes precedence, while maintaining proper spacing between stones. Alternatively, the orientation of the veining patterns and the thickness of the stone may be exploited to create an artistic expression of dimensional profiles or sculptured imagery by specific placement of classified stones in desired positions. The designed flooring or facade project is then presented both visually and quantified in report and display generator 140.

[Para 14] Fig. 2 illustrates an exemplarily block diagram of the method in accordance with an embodiment of the present invention. The quantity of natural stone products required for a construction project is first estimated based on standard industry practices, such as volumetric calculations from area and thickness and contingency factors such as waste and availability of materials. At the start of the characterization of 200, the natural stone product is scanned 210, classified and indexed 220. The design rules 230 specified by the architect are specified, and placement and orientation of each stone is optimized 240. The project is displayed graphically 250 and in tabulated form 260. An electronic acceptance of 250 and 260 is included in 270, thus completing the characterization of the natural stone products 280.

[Para 15] Accordingly, in one embodiment, the present invention generally relates to automated methods and apparatus to characterize individual natural stone products. In another embodiment, a detailed report with visually accurate depiction of a natural stone project can be generated.

[Para 16] The foregoing description has been directed to specific embodiments. It will be apparent to those with ordinary skill in the art that modifications may be made to the described embodiments, with the attainment of all or some of the advantages. For example, the techniques of the present invention may be applied to any type of natural stone products in any construction setting. Also, a dedicated machine is not required to provide embodiments of the present invention. Instead, the classification may be performed at the stone quarry or at the construction site. Therefore, it is the

object of the appended claims to cover all such variations and modifications as come within the spirit and scope of the invention.